

Original investigation

Association of Cigarette Smoking With Interpersonal and Self-Directed Violence in a Large Community-Based Sample

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Abstract

Introduction: Substance use is a major risk factor for various forms of violence, yet how cigarette smoking influences violence outcomes is incompletely understood. We investigated associations between cigarette smoking and three types of violence in a large, nationally representative, community-based sample.

Methods: Adult subjects participating in both Wave 1 (2001–2002; $N = 43\,093$) and Wave 2 (2004–2005; $N = 34\,653$) of the National Epidemiological Survey on Alcohol and Related Conditions (NESARC) were stratified by daily cigarette smoking status at Wave 1, and individuals with unchanged smoking status between waves were analyzed (nonsmokers [consisting of never and former daily smokers]: $N = 22\,529$; daily smokers: $N = 7442$). We created composites of other- and self-directed violence and victimization occurring between Waves 1 and 2, and performed logistic regression models, controlling for psychiatric diagnoses, alcohol and substance use, and relevant demographic covariates.

Results: Daily smokers at Wave 1 were 2.1 (95% CI: 1.5–3.0), 2.5 (2.1–2.9), and 1.7 (1.5–2.1) times more likely than nonsmokers to report self-directed violence, other-directed violence, or victimization between Waves 1 and 2, respectively. Former daily smokers were significantly less likely to report other-directed violence than individuals who were never daily smokers.

Conclusions: Daily cigarette smoking is temporally associated with multiple forms of violence compared to never and former cigarette smokers, even when common covariates associated with violence are controlled. Smoking status should be carefully controlled for in studies designed to identify risk factors for violence, and may be a useful component of violence risk assessment.

Implications: The findings suggest that cigarette smoking status should be carefully and systematically controlled for in studies of violence risk factors. The findings also support further investigation of the utility of cigarette smoking status for violence risk assessment, and whether smoking cessation strategies mitigate violence risk.

Introduction

More than 1 billion individuals worldwide use tobacco, primarily through cigarette smoking.¹ Despite its prevalence, the association of cigarette smoking and violence outcomes is incompletely understood. Previous studies consistently support the association of substance

use with violence directed toward self and others, as well as victimization.^{2–5} However, many of these studies do not examine cigarette smoking independently and frequently do not adjust for cigarette smoking.^{3,5,6} Controlled studies using animal models of aggression or human experimental psychology protocols demonstrate tobacco,

nicotine, and nicotine withdrawal might influence aggressive behavior directly (reviewed in ref.⁷), or influence processes such as mood and anxiety,^{7,8} impulsivity,⁹ and emotional reactivity¹⁰ that indirectly regulate aggression and violence. Additionally, factors associated with initiation and maintenance of cigarette smoking, such as trait hostility¹¹ and early life abuse⁴ might also increase the risk for violence or victimization. A better understanding of the relationship between cigarette smoking and violence might enable more accurate stratification of violence risks and may identify practical strategies for its reduction through smoking cessation interventions.

The National Institute on Alcohol Abuse and Alcoholism—National Epidemiological Survey on Alcohol and Related Conditions^{12,13} (NESARC) is well designed to address these questions in a United States community-dwelling sample given its large sample size, two-wave design, and extensive data on psychiatric and substance use diagnoses and violence measures. Previous studies using Wave 2 data of the NESARC dataset found that lifetime history of nicotine dependence (ND) significantly increases the odds of other- and self-directed violence, even after controlling for lifetime history of comorbid serious mental illness and other substance use disorders (SUDs).² Because this study examined effects of lifetime smoking history on adult lifetime violence data, it was not informative as to how tobacco exposure might influence violence risks in a temporally-based association. We hypothesized that current smokers at Wave 1 would report increased violence measures between waves compared to individuals not smoking at Wave 1. We also sought to test whether violence measures differed for individuals who had previously smoked and quit as compared to those continuing to smoke or who had never smoked. We performed this analysis controlling for important demographic variables, as well as major psychiatric disorders and SUDs.

Methods

Sample

The National Institute on Alcohol Abuse and Alcoholism NESARC was conducted in two waves (Wave 1: 2001–2002, *N* = 43 093; Wave 2: 2004–2005, *N* = 34 653) on community-dwelling, non-institutionalized individuals age ≥18. A detailed methodological description can be found elsewhere.^{12–15} Surveys were performed face-to-face by experienced, trained lay interviewers using computer-assisted personal interviews, with an original survey response rate of 81% at Wave 1, and 80% of original respondents sampled at Wave 2. African Americans, Hispanics, and young adults were oversampled, with data adjusted for oversampling and household and person-level nonresponse. The data were adjusted on sociodemographic variables based on year 2000 census data to better represent the US population. Wave 2 data were adjusted for nonresponders, demographic factors, and psychiatric diagnoses.

Participants were included in the current analyses if they: (1) completed both Wave 1 and Wave 2 surveys; and (2) were daily smokers, former daily smokers, or never-smokers at Wave 1 and their smoking status remained stable between waves (ie, former smokers did not report a relapse in the 3 years between Waves 1 and 2; daily smokers continued daily smoking at Wave 2). Analyses included a final sample of 29 971 individuals, and demographics, psychiatric diagnoses during the past year, alcohol and other substance dependence during the past year, and daily smoking status were obtained from Wave 1 data. Self-directed violence, other-directed violence, and victimization during the 3 years between Waves 1 and 2 were obtained from Wave 2 data.

Measures

Violence

Composites of self-directed violence, other-directed violence, and victimization that occurred between Waves 1 and 2 were created (Supplementary Table). Individuals endorsing any of the individual items included within a given category were coded as positive (coded as 1) for that category. The “self-directed” violence category included items assessing: suicide threats, suicide attempts, and self-injury. Each of the self-directed violence items included the report of the last time this occurred and individuals were scored positively for each item if the reported age occurred between the Wave 1 and Wave 2 dates. The “other-directed” violence category included items assessing threatening, physical violence against others including sexual violence, robbery or mugging, and use of weaponry against others. The “victimization” category included having been threatened, physically attacked, raped, or mugged since last interview.

Smoking Status

Smoking status was assessed at Wave 1 and Wave 2. At Wave 1, participants were asked, “When was the most recent time you smoked?” and “How often did you usually smoke in the last year?” Participants who reported typically smoking daily in the past 12 months prior to Wave 1 were coded as “current daily smokers.” Participants who reported that they had never smoked were coded as “never-smokers,” and participants who reported that they did not currently smoke daily, but had smoked daily in the past (prior to 12 months before Wave 1) were coded as “former daily smokers.” Individuals were also stratified by whether they met Diagnostic and Statistical Manual (*DSM-IV*) criteria for ND at both Wave 1 and Wave 2, again excluding individuals whose ND status changed between waves.

Past Year Psychiatric, Alcohol, and Other Substance Diagnoses

Past 12-month diagnoses of depressive episodes, manic episodes, anxiety disorders, alcohol use disorders and other SUDs (all illicit substance use combined into one variable for the purpose of the current analyses) were assessed at Wave 1 as part of the Alcohol Use Disorder and Associated Disabilities Interview Schedule-IV (AUDADIS-IV), which is based on *DSM-IV* diagnostic criteria.^{16,17} For the purpose of the current analyses, each of these variables was coded as not present in the last 12 months (0) or present in the last 12 months (1).

Covariates

Covariates were age, sex, education, and race/ethnicity. Race/ethnicity categories included white/Caucasian, black/African American, American Indian, and Hispanic, any race.^{16,17} Education categories included less than high school, high school degree, and some college or more. Age was entered into the regressions as a continuous variable. Sex, education, and race/ethnicity were entered into the regressions as categorical variables (Table 1).

Analyses

Using data from those participants who were either current daily smokers, former daily smokers, or never-smokers at Wave 1 and whose smoking status remained stable during the 3 years between Waves 1 and 2, we first stratified the sample by smoking status and computed descriptive statistics for covariates, psychiatric diagnosis, alcohol use, other substance use, and violence outcomes (Table 1). Three stepwise, binary logistic regression models were

Table 1. Sample Demographics and Description for Overall Sample, Nonsmokers, and Daily Smokers

	Overall sample (N = 29 971)	Nonsmokers ^a (N = 22 529)	Daily smokers ^b (N = 7442)
Mean age (SD)	45.37 (16.91)	46.47 (17.48)	42.03 (14.55)
Sex			
Male	44.6%	41.3%	54.5%
Female	55.4%	58.7%	45.5%
Education			
Less than high school	14.4%	12.8%	19.1%
High school	29.1%	26.6%	36.5%
Some college +	56.6%	60.6%	44.4%
Race			
White	72.3%	70.4%	78.2%
African American	10.9%	11.3%	9.7%
Native American	2.1%	1.7%	3.4%
Asian	4.1%	4.8%	2.0%
Hispanic	10.5%	11.8%	6.7%
Mood disorder past year	8.9%	7.2%	14.0%
Manic episode past year	3.2%	2.4%	5.6%
Anxiety disorder past year	12.1%	10.5%	16.7%
Alcohol dependence past year	3.2%	1.7%	7.9%
Substance dependence past year	0.6%	0.1%	1.8%
Self-directed violence (between waves) ^c	0.6%	0.4%	1.2%
Victimization (between waves) ^d	2.3%	1.6%	4.2%
Other-directed violence (between waves) ^e	2.4%	1.4%	5.2%

Demographic measures, psychiatric and substance use diagnoses, and violence outcomes all differed significantly ($P < .05$) between daily smokers and nonsmokers.

^aNonsmokers included former daily smokers (no smoking within 12 months of Wave 1) and never-smokers.

^bDaily smokers reported smoking daily in the past 12 months prior to Wave 1.

^cSelf-directed violence refers to suicide attempts.

^dVictimization includes having been threatened, physically attacked, raped, or mugged.

^eOther-directed violence includes threatening, physical violence against others including sexual violence, committing robbery or mugging, and using weaponry against others

then performed for violence forms occurring between Waves 1 and 2: (1) self-directed violence; (2) other-directed violence; and (3) victimization. In each model we entered the variables using a stepwise approach to control for the influence of the prior step: Step (1) covariates (age, sex, education, race/ethnicity); Step (2) psychiatric diagnoses (depression, mania, anxiety), alcohol, and other substance use diagnoses; and Step (3) smoking status. Thus, the analysis tested the independent contribution of smoking status in predicting violence in excess of the covariates and other Axis I psychiatric and SUDs. Analyses were conducted using IBM SPSS Statistics Version 21.

Results

We identified 7442 (25%) participants who were daily smokers at Wave 1 and remained daily smokers at Wave 2. We identified 22 529 (75%) participants who had not smoked in the 12 months prior to Wave 1, nor in between the waves. Descriptive statistics for individuals with stable smoking status across both waves are reported in Table 1. Current daily smokers were more likely to be younger, male and less educated, and more likely to meet criteria for a mood disorder, manic episode, anxiety disorder, or alcohol and substance dependence. Among current daily smokers, 1.2% reported self-directed violence, 5.2% reported other-directed violence, and 4.2% reported victimization between Waves 1 and Wave 2. Among former smokers and never-smokers, 0.4% reported self-directed violence, 1.4% reported other-directed violence, and 1.6% reported victimization between Waves 1 and Wave 2.

Initial analyses employed a three-group approach for smoking status: never-smokers, former daily smokers (daily smoking prior to 12 months before Wave 1), and current daily smokers (daily smoking within 12 months of Wave 1). In each of the three logistic violence models, smoking conferred increased unique risk for violence and victimization above that predicted by demographic variables and other psychiatric, alcohol, and substance use disorders entered on prior steps of the models. Individuals who were stable current daily smokers reported more self-directed violence, other-directed violence, and victimization as compared to both former smokers and never-smokers (Table 2). Former daily smokers did not significantly differ from never daily smokers in the odds of self-directed violence and victimization, and were significantly less likely than never-smokers to report other-directed violence. Given the similarities between never and former daily smokers, we collapsed these groups into a single nonsmoker group to enable direct comparison of nonsmokers and daily smokers. In this analysis, the odds ratios of self-directed violence, other-directed violence, and victimization in daily smokers compared to nonsmokers were 2.1 (95% CI: 1.5–3.0), 2.5 (2.1–2.9), and 1.7 (1.5–2.1), respectively.

We also conducted analyses comparing individuals who met criteria for current DSM-IV ND at Wave 1 versus participants who did not meet criteria for ND at Wave 1, again excluding individuals whose dependence status changed between waves. We reasoned that meeting ND criteria might be indicative of heavier smoking than those not meeting criteria. Similar to our findings with the less stringent groupings (Table 2) as well as previous studies examining lifetime history of ND,² individuals meeting criteria for past year ND were significantly more likely to report between-wave self- and

other-directed violence and victimization (Table 3). We again found that former ND individuals were significantly less likely than never ND individuals to report other-directed violence.

Discussion

The objective of this study was to determine whether daily cigarette smoking is temporally associated with three measures of violence in a large community-dwelling sample after controlling for important confounding factors. We found that after adjusting for demographics, psychiatric disorders, and SUDs, daily cigarette smoking at NESARC Wave 1 compared to nonsmokers is predictive of both self- and other-directed violence as well as victimization between the first and second NESARC interviews, respectively increasing the odds by 2.1, 2.5, and 1.7. This study further refines and extends the previously identified association between lifetime history of ND

and violence² by assessing the temporal association, victimization outcomes, and the inclusion of less stringent smoking categories in addition to ND. It is remarkable to note that the violence risk conferred by daily cigarette smoking as revealed in the third step of our logistic model is comparable to that of substance and alcohol use, both of which have been long recognized as significant risk factors for violence and victimization.

How cigarette smoking is associated with violence and victimization likely has both neurobiological and social underpinnings. One explanation of our findings is that exposure to ongoing daily cigarette smoking directly leads to increased violence and victimization, although our study design cannot support a causal association. This possibility is suggested by our finding that violence outcomes of Wave 1 former daily smokers resembled those of never daily smokers as opposed to Wave 1 current daily smokers. Nicotine and other components of tobacco may influence brain regions and neural

Table 2. Comparison of Smoking Status at Wave 1 (Never-Smoker, Former Daily Smoker, and Current Daily Smoker) on Self-Directed Violence, Victimization, and Other-Directed Violence Occurring Between Wave 1 and Wave 2

Predictor	Self-directed violence		Victimization		Other-directed violence	
	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI
Step 1***						
Step 2						
Mood disorder (PY)	4.36**	2.98–6.38	1.62**	1.29–2.05	1.93**	1.54–2.43
Manic episode (PY)	2.22**	1.44–3.40	1.41*	1.06–1.89	1.52**	1.14–2.02
Anxiety disorder (PY)	2.41**	1.67–3.46	1.43**	1.15–1.78	1.19	0.95–1.49
Alcohol dependence (PY)	2.14**	1.31–3.48	2.34**	1.81–3.02	1.77**	1.37–2.30
Substance dependence (PY)	1.29	0.59–2.79	1.91**	1.22–3.00	1.57	1.00–2.47
Step 3**						
Never daily smoker	—	—	—	—	—	—
Former daily smoker	1.43	0.73–2.82	1.02	0.73–1.42	0.55**	0.41–0.73
Current daily smoker	2.67**	1.35–5.29	1.64**	1.17–2.30	1.40*	1.05–1.87

PY = past year. Each step in the hierarchical regression provided significantly more predictive ability to our model. Violence was coded as 0 = no violence in between waves and 1 = violence in between waves. Smoking status was coded as 0 = never or former daily smoker and 1 = current daily smoker at Wave 1.

Significant correlations at the .05 level are denoted by * and by ** at the .01 level.

***Covariates included age, sex, race, ethnicity, and education. The covariates were all significant ($P < .05$) for victimization (younger age, being female, lower education) and other-directed violence (younger age, being male, and lower education). Significant covariates for self-directed violence were age (younger) and sex (being male).

Table 3. Comparison of Nicotine Dependence Status at Wave 1 (Never Nicotine Dependence, Former Nicotine Dependence, and Current Nicotine Dependence) on Self-Directed Violence, Victimization, and Other-Directed Violence Occurring Between Wave 1 and Wave 2

Predictor	Self-directed violence		Victimization		Other-directed violence	
	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI
Step 1***						
Step 2						
Mood disorder (PY)	4.26**	2.97–6.11	1.48**	1.19–1.84	1.65**	1.33–2.05
Manic episode (PY)	2.10**	1.39–3.19	1.37*	1.04–1.81	1.58**	1.21–2.07
Anxiety disorder (PY)	2.11**	1.49–2.99	1.40**	1.15–1.72	1.15	0.94–1.42
Alcohol dependence (PY)	1.80*	1.13–2.87	2.16**	1.72–2.73	1.65**	1.30–2.09
Substance dependence (PY)	1.10	0.51–2.38	1.62*	1.05–2.50	1.60*	1.05–2.45
Step 3**						
Never dependent	—	—	—	—	—	—
Former dependent smoker	0.88	0.48–1.61	0.97	0.72–1.31	0.53**	0.41–0.68
Current dependent smoker	2.22*	1.19–4.12	2.20**	1.60–3.03	1.58**	1.21–2.08

PY = past year. Each step in the hierarchical regression provided significantly more predictive ability to our model. Violence was coded as 0 = no violence in between waves and 1 = violence in between waves. Nicotine dependence was coded as 0 = never or former dependent smoker and 1 = current dependent smoker at Wave 1. Significant correlations at the .05 level are denoted by * and by ** at the .01 level.

***Covariates included age, sex, race, ethnicity, and education.

circuitry of aggression or other related psychological states directly, especially mood, anxiety, and impulsivity (reviewed in refs.^{7,8}). Human FDG-PET studies provide evidence for interaction between anger, hostility, and nicotine.^{18,19} Daily cigarette use may also expose individuals to subclinical mood and anxiety symptoms during the smoking cycle, especially by exposure to inter-cigarette withdrawal symptoms that can begin within minutes after smoking.²⁰ Acute nicotine withdrawal increases aggressive responses^{20,21} and emotional reactivity,¹⁰ and both cigarettes and purified nicotine delivery can reduce aggressive behavior²¹ or emotional reactivity.¹⁰ Smokers compared to nonsmokers demonstrate increased levels of impulsivity and reward sensitivity and underestimate aversive outcomes,^{22,23} which can predispose to violence and suicide.²⁴ Interestingly, certain forms of nicotine administration have been shown to reduce aggression in rodent models^{25–27} and in case reports of humans with persistent aggression secondary to neuropsychiatric disorders such as autism spectrum disorder²⁸ and dementia.^{29,30} These findings, taken together, suggest that the ultimate effects of nicotine and tobacco on aggression and violence are influenced by the duration and kinetics of delivery as well as the use of purified nicotine versus the complex mixture of tobacco products.

The presence of risk factors that were not controlled for in our study but which increase the likelihood of both violence and ongoing cigarette smoking within individuals is another potential explanation for our findings. Individuals in the current daily smoker group may have exposure to factors that make smoking cessation more challenging and also increase the risk of violence as compared to former smokers, who were successfully able to quit smoking and sustain abstinence. For instance, trait hostility is predictive of cigarette smoking¹¹ and predicts negative affect during acute nicotine withdrawal,²³ which might maintain nicotine use in such individuals and impede quit attempts. Furthermore, early life abuse, a strong risk factor for violence,⁴ intensifies the severity of nicotine withdrawal symptoms and is associated with increased ND.³¹ Early exposure to secondhand smoke is associated with increased antisocial behavior in later childhood.³² Early smoking initiation, which is associated with greater smoking rates at later ages,³³ is also associated with predatory and relational violence by late adolescence.³⁴ Finally, chronic cigarette smoking may serve as a marker of heightened impulsive aggression, which has been proposed as an endophenotype of early-onset suicidal behavior.³⁵ Taken together, our finding that daily smoking is temporally associated with violence may be explained in part by shared risk factors for daily smoking and violence that are not captured by major demographics, psychiatric diagnoses, or alcohol and substance use.

Our finding that cigarette smoking is predictive of future victimization is consistent with previous studies of intimate partner violence (IPV). Women exposed to IPV are significantly more likely to smoke or chew tobacco than those not experiencing IPV.³⁶ Smoking status in married couples (and presumably nonmarried couples) is correlated,³⁷ and thus our finding that individuals who are daily smokers increasingly report violence toward others as well as report victimization is likely partially explained by a substantial IPV component. A previous analysis of NESARC³⁸ found that daily and intermittent smoking were associated with certain forms of IPV-perpetration and victimization when compared to lifetime nonsmoking. Former smoking was not significantly or only weakly associated with IPV when compared to lifetime nonsmoking, consistent with our findings in the broader constructs of other-directed violence and victimization. Finally, while our study did control for demographic

variables that are proxies for socioeconomic status, such as educational attainment, we did not control for increasingly specific factors such as income, employment status, or dwelling place. As these factors are known to be associated with victimization^{39,40} and cigarette smoking,⁴¹ uncontrolled social factors may further contribute to our findings on victimization.

Several limitations should be considered when interpreting our findings. Because the NESARC dataset cannot identify the absolute time relationship between smoking onset and violence onset, our study is unable to establish a causal relationship between cigarette smoking status and violence. Violence and victimization were measured by self-report, which may influence the accuracy of reporting. Furthermore, the measures of other-directed violence do not enable rigorous differentiation between proactive, predatory violence and defensive, reactive violence. Future research focusing on such motivational aspects might help clarify the mechanism underlying the associations. Individuals whose smoking status changed between waves were excluded from our analysis, which limited confounding by the effects of nicotine withdrawal during quit attempts or the use of smoking cessation aids. Future analysis of the effect of smoking transitions on violence may be informative of the neurobiological and social factors mediating the association. For example, our finding that former smokers are less likely to report other-directed violence compared to never-smokers could result from lifestyle changes that reduce both the likelihood of ongoing smoking and violence, such as a new marriage to a nonsmoker or new employment at a smoke-free workplace. Similarly, the emergence of new psychiatric and substance use conditions during the NESARC inter-wave interval was not accounted for, and it is possible that such conditions might serve to confound these associations. Despite its large sample size, the relative infrequency of reported violence limited the statistical power to identify interactions between smoking status and psychiatric and substance use conditions on violence outcomes as well as to identify dose-response relationships between smoking and violence. NESARC did not include individuals residing in correctional facilities, psychiatric hospitals, and residential alcohol and substance treatment centers. These individuals likely account for a higher burden of violence and victimization than the community sample, and we are therefore unable to determine how daily cigarette smoking would be associated with the above forms of violence in this population. Finally, assessment of schizophrenia and other psychoses in NESARC was not based on component diagnostic symptoms but by symptom self-report, and thus was not included in our analysis. Individuals with schizophrenia are well known to smoke cigarettes at a higher rate than the general population⁴² and are much more likely to be victimized⁴³ and to attempt suicide.⁴⁴ Thus, not controlling for schizophrenia, whose prevalence is ~1% of the general population, might falsely increase the apparent odds of these forms of violence with daily smoking.

Our results have important implications for researchers, clinicians, and public policy makers. These findings argue for more consistent controls for smoking status in studies assessing violence risk factors. They also serve to support future investigation of the utility of smoking cessation strategies as a means to reduce the risk of violence and victimization in currently smoking individuals. At the clinical level, these associations suggest that daily cigarette smokers might benefit from more consistent screening for violence and victimization in a manner similar to the assessment of individuals with alcohol and other SUDs. Future animal model or human

neurobiological research into the basic mechanisms by which nicotine and other tobacco components interact with processes governing aggression may also help interpret our findings. Finally, our results suggest that policies aimed at reducing cigarette smoking may have public health implications of even greater magnitude than solely the reduction of smoking-related diseases.

Supplementary Material

Supplementary Table can be found online at <http://www.ntr.oxford-journals.org>

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Declaration of Interests

None declared.

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